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The Asa Gray Bulletin for June appears in an enlarged and improved form. The editors say in regard to it: "For some time it has been felt that there is room in the United States for a botanical magazine of a more popular nature than any which now occupy the field," and they hope to make the little magazine fill this place. G. H. Hicks of Kensington, Md., the Editor-in-Chief, is to be aided by a number of well known botonists. It should be widely circulated in the public schools.

M. C. Fernald's "Second Supplement to the Catalogue of Maine Plants" appears in the *Proceedings of the Portland Society of Natural History* (Vol. II, Part 4). It contains 101 species and varieties, several of which are described as new to science. Among the interesting additions are *Prunus cuneata* Raf., *Lythrum alatum* Pursh, *Coreopsis tinctoria* Nutt., *Fraxinus viridis* Michx. f., *Solanum rostratum* Dunal, and *Sassafras officinalis* Nees.

A new book on fossil plants is now appearing in parts from the publishing house of Ferd. Dummlers, Berlin. It is the work of Dr. H. Potonié, and bears the title of *Lehrbuch der Pflanzenpaleontologie.* The first *lieferung* contains 112 pages, and includes chapters on "fossil plants in general," "doubtful fossil plants," and a "systematic discussion of fossil remains." It is freely illustrated.

Professor F. Lamson-Scribner, the agrostologist of the Department of Agriculture, in Washington, D. C., has made a valuable contribution to our knowledge of the grasses of the United States by bringing out an illustrated bulletin (No. 7) under the title of "American Grasses," consisting of excellent figures of three hundred and two species. Accompanying each is a brief description. It is to be hoped that larger editions of these useful publications may be made in the future, so that they may receive wider distribution.—CHARLES E. BESSEY.

VEGETABLE PHYSIOLOGY.

Chemotropism of Fungi.—Manabu Miyoshi, a student of Pfeffer in Leipsic, has considerably extended our knowledge of the behavior of fungi toward particular substances, and has opened up a wide field for speculation and experiment relative to the causes of parasitism. He experimented at first with six common fungi, all usually designated as Saprophytes, viz.: *Mucor mucedo, M. stolonifer, Phycomyces nitens, Penicillium glaucum, Aspergillus niger* and *Sapro-*

legnia ferax. Subsequently he also experimented with *Botrytis bassiana*, *B. tenella*, *Uredo linearis* and with the pollen of *Digitalis purpurea* and of some other Dicotyledons, the results being much the same except that they are attracted by fewer substances. In brief, he finds the germ tubes of the species experimented on to be indifferent to some substances, to be repulsed by others, and to be strongly attracted by still others. In some cases the attraction is so strong that an indifferent fungus-like Penicillium is converted into an active parasite by simply injecting the living leaves on which the spores are sown with a dilute solution of the attractive substance, e. g., 2 per cent. cane sugar. The germ tubes bore through the epidermis or enter at the stomata and ramify through the interior of the leaf, boring through cells as well as passing between them, while they show no tendency to enter leaves injected simply with water. The suggestiveness of this sort of an experiment is certainly very great. The spores were separated from the chemotropic substance by films of mica or collodium perforated with fine needle punctures, or by means of the epidermis of various plants. Without entering into details, some of the main conclusions reached by Mr. Miyoshi may be summed up in the following diagrams which I have prepared from his tables. These experiments were made with layers of gelatin separated by thin films of collodium containing fine needle punctures. The interrupted horizontal lines represent collodium membranes separating layers of 5 per cent. gelatin, previously washed in HCl to remove the disturbing, nutrient lime salts. The dotted areas indicate the particular layer of gelatin containing the spores to be tested. The diagonally shaded areas indicate the layers of gelatin to which the chemotropic substance was added, in these cases 2 per cent. cane sugar. The vertical lines represent the walls of the glass dishes. The arrows indicate the direction of the movement of the germ tubes when there was marked chemotropism. Zero denotes that there was no movement of the germ tubes into the compartment, and * indicates that the germ tubes grew indifferently in all directions. In the first diagram the experiments were with *Phycomyces nitens* and *Mucor stolonifer*, in the second with *M. stolonifer*.

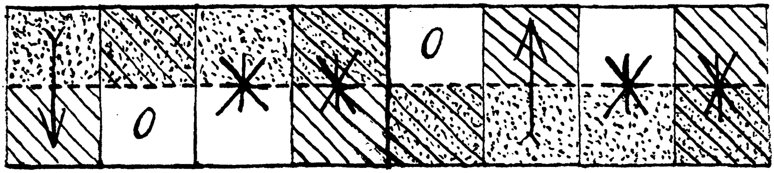

Fig. 1.

Mr. Miyoshi finds that within certain limits it is the difference in the concentration of the chemotropic substance in two layers rather than the amount of concentration which controls movement. Positive chemotropism gradually disappears as diffusion renders the concentration slight. The concentration difference must be 1 : 10 or more to induce decided turning. If the concentration is great, negative chemotropism is apt to set in, e. g., *Mucor mucedo* shows strong, positive chemotropism to 2 per cent. cane sugar solution, it is feebly positive with 0.1 per cent., while with diluter solutions the fungus does not react; with solutions stronger than 2 per cent. the positive reaction increases up to 10 per cent., and then slowly decreases at 15, 20 and 30 per cent., becoming negative at 50 per cent. We reproduce one of Mr. Miyoshi's figures showing the movement of the germ tubes of *Saprolegnia ferax* into a puncture in a collodium plate through which 2 per cent. meat extract was diffusing. Hyphae inside the circle of diffusion always turned their growing point toward the zone of higher concentration and finally entered the opening where it was strongest. Identical results were obtained in light and dark rooms. The experiments seem to have excluded heliotropism, geotropism and all movements due to simple contact.

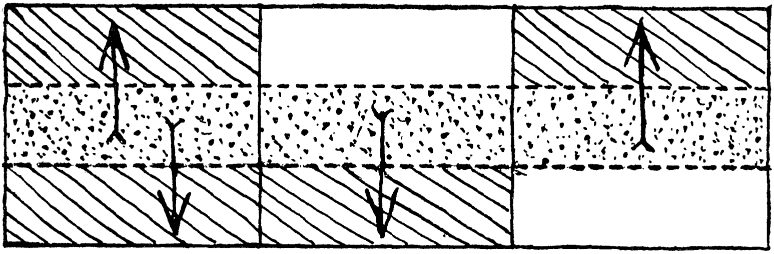

Fig. 2.

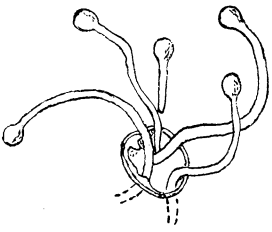

Fig. 3.

Pfeffer's capillary tubes in water or very dilute nutrient solutions under cover glasses were also used, but this method, while giving some interesting results, is stated to be better adapted to motile organisms. Many substances were found to attract, and a long list is given with the behavior of the six fungi first mentioned toward different concentrations. Among the strongly attractive substances were ammonia compounds, phosphates, meat extract, peptone, sugar, dextrin, asparagin, etc. The following compounds caused repulsion: organic and inorganic acids, alkalies, alcohol, calcium nitrate, magnesium sulfate, sodium chloride, potassium nitrate, chlorate and chloride. The nutrient value of a substance, it is said, in no way corresponds to its chemotropic stimulus. Glycerin is cited as example of a good food which has scarcely any chemotropic action. The five molds were specially attracted by sugar, while the Botrytis showed a special preference for meat extract and peptone and no liking for grape or cane sugar. The pollen tubes were indifferent to meat extract, peptone and asparagin, but were attracted by grape sugar, cane sugar, dextrin and plum decoction. The title of this paper is *Ueber Chemotropismus der Pilze.* It occupies all of *Botanische Zeitung.* 52 Jahrg. 1 Abt. Heft I., and is well worth reading by all who are interested in the cultivation of fungi.

—ERWIN F. SMITH.

ZOOLOGY.

Origin of Life.—The following interesting speculation as to the origin of the organic forms of the earth is advanced by Mr. Charles Morris. There was a time in the earth's history, when chemical inaction prevailed, on account of high temperature and unfavorable physical conditions, but, on the formation of an ocean of highly heated waters, holding in solution a variety of elementary substances and simple compounds, chemism grew active, and became more energetic as the waters increased in depth and in variety and volume of their contents. Many complex minerals were very likely then formed and deposited as rock formations. As the ocean became freed from its abundance of foreign material inorganic chemistry decreased, until now it has practically ceased, oxidation having reduced nearly all substances to a state of chemical fixity.

As the waters of the primeval ocean slowly cooled, and inorganic chemism declined in activity, organic chemism probably set in, aided by the solar rays. The material for this new phase of action had been prepared and existed abundantly in the water and air. It may have had its origin in an early reaction between carbon dioxide and the elements of water, yielding the hydro-carbons; and subsequently between these and nitrogen, yielding the far more complex albuminous compounds.